Electronic Version
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Claims

[c1] A method of performing object detection within a collision warning and countermeasure system comprising:
generating an object detection signal;
generating an image detection signal;
determining at least one center-of-reflection and at least one center-of-intensity in response to said object detection signal and said image detection signal;
associating said at least one center-of-intensity with said at least one center-of-reflection;
determining difference between said at least one center-of-reflection and said at least one center-of-intensity for a plurality of frames and generating a sensor difference signal; and
classifying at least one object in response to said sensor difference signal.

[c2] A method as in claim 1 wherein generating an object detection signal comprises performing an upramp sweep and a downramp sweep.

[c3] A method as in claim 1 wherein generating an object detection signal comprises determining range and range-rate for at least one object.

[c4] A method as in claim 1 wherein generating an object detection signal comprises gating and pairing targets for at least one object.

[c5] A method as in claim 1 wherein generating an object detection signal comprises determining relative velocity and relative direction of travel for at least one paired target.

[c6] A method as in claim 1 wherein determining at least one center-of-reflection comprises transforming polar coordinates of said object detection signal into Cartesian coordinates.

[c7] A method as in claim 1 wherein determining at least one center-of-reflection comprises:
performing a perspective transform of said world coordinates into image coordinates; and
determining said at least one center-of-reflection in response to said image coordinates.

[c8] A method as in claim 1 further comprising determining at least one centroid in response to said at least one center-of-intensity.

[c9] A method as in claim 8 wherein determining at least one centroid comprises determining a current frame region-

of-interest in response to a prior frame region-of-interest.

[c10] A method as in claim 8 wherein determining at least one centroid comprises adjusting size of a current frame region-of-interest in response to a prior frame region-of-interest and in response to said sensor difference signal.

[c11] A method as in claim 8 wherein determining at least one centroid comprises:
determining whether an object is a false object or a ghost object and generating an error signal; and
determining whether to use said sensor difference signal when determining a subsequent region-of-interest in response to said error signal.

[c12] A method as in claim 8 further comprising:
determining a first set of vectors between said at least one center-of-reflection and said at least one centroid for a prior frame region-of-interest;
determining a second set of vectors between said at least one center-of-reflection and at least one updated centroid for a current frame region-of-interest; and
generating said sensor difference signal in response to said first set of vectors and said second set of vectors.

[c13] A method as in claim 12 wherein generating said sensor difference signal comprises averaging differences between said second set of vectors and said first set of vectors.

[c14] A method as in claim 1 wherein generating said sensor difference signal comprises accounting for errors between said at least one center-of-reflection and said at least one center-of-intensity.

[c15] A collision warning and countermeasure system for an automotive vehicle comprising:
at least one object detection sensor generating an object detection signal;
at least one image generating sensor generating an image detection signal; and
a controller electrically coupled to said at least one object detection sensor and said at least one image generating sensor, said controller determining at least one center-of-reflection and at least one center-of-intensity in response to said object detection signal and said image detection signal, associating said at least one center-of-intensity with said at least one center-of-reflection, determining difference between said at least one center-of-reflection and said at least one center-of-intensity for a plurality of frames and generating a sensor difference signal, and classifying at least one

object in response to said sensor difference signal.

[c16] A system as in claim 15 wherein said object detection sensor in generating said object detection signal performs an upramp sweep and a downramp sweep.

[c17] A system as in claim 15 wherein said controller in determining said at least one center-of-reflection gates and pairs targets generated from said radar sensor performing an upramp sweep and a downramp sweep.

[c18] A system as in claim 15 wherein said controller determines at least one centroid in response to said at least one center-of-intensity and determines a set of vectors between said at least one center-of reflection and said at least one centroid.

[c19] A system as in claim 18 wherein said controller compares differences between said set of vectors and an average distance parameter to determine an updated average distance parameter and determines a subsequent set of regions-of-interest in response to said updated average distance parameter.

[c20] A method of performing object detection within a collision warning and countermeasure system comprising: generating an object detection signal by performing an upramp sweep and a downramp sweep;

generating an image detection signal;

determining at least one center-of-reflection and at least one center-of-intensity in response to said object detection signal and said image detection signal;

associating said at least one center-of-intensity with said at least one center-of-reflection;

determining difference between said at least one center-of-reflection and said at least one center-of-intensity for a plurality of frames and generating a sensor difference signal;

determining at least one centroid in response to said center-of-intensity;

determining a set of vectors between said at least one center-of-reflection and said at least one centroid;

comparing differences between said set of vectors and an average distance parameter to determine an updated average distance parameter;

determining a subsequent set of regions-of-interest in response to said updated average distance parameter;

determining updated centroids in response to said subsequent set of regions-of-interest; and

classifying and tracking at least one object in response to said updated centroids.